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**The Use of Ultraviolet Excitation of Native Fluorescence for Identifying Biomarkers in
Halite Crystals**

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Abstract- Recent findings by the NASA's Mars Exploration Rovers and ESA's Mars Express indicate that during an earlier era in the planets' evolution, evaporation of surface water may have left behind vast evaporite deposits 1,2,3 . This makes the possibility of finding biological material preserved in halite inclusions most intriguing 4. The retrieval and characterization of microorganisms from ancient halite crystals 5,6 suggests that it might be possible to locate their remains as biomarkers or even living cells from evaporites sampled from extraterrestrial environments. However, before this is possible, techniques for the detection of bacterial cells or biomolecules in halite and other evaporite crystals need further refining. Specifically, contamination must be minimized and quantified during the microbial analysis of such crystals. Aseptic techniques that allow for the direct extraction of fluid brines from micron to millimeter size inclusions significantly reduce the possibility for contamination. However, even with extreme precautions, the possibility for contamination cannot be entirely eliminated, particularly when culture-based methods are employed.

We have elicited native fluorescence from a variety of biomolecules, including the aromatic amino acids and nucleic acids, by laser excitation at 248 and 224 nm from haloarchaea and haloarchaea residues trapped in halite. Energy to each sample, (positive control crystals with *Halobacteria salinarum* and bacteria-free negative control crystals), was 80 microwatts at 224 nm and 25 microwatts at 248 nm. A 30 s exposure of the inclusions within the positive control elicited easily detectable fluorescence while there was no response from the negative control crystals during the same exposure. Analysis of halite crystals sampled from the Waste Isolation Pilot Plant, Carlsbad, New Mexico yielded similar results. To minimize microbial damage from the high-energy 224-248 nm beams and to make the technique more widely available to the scientific community, we have examined the possibility of using a standard epi-fluorescent microscope for similar purposes. We have also elicited a native fluorescence response from microscopic eukaryotes in rapid scanning, low magnification mode employing 365 nm excitation and are optimizing the visualization of prokaryotes with this system. Aseptic identification of epifluorescent biosignatures in evaporite inclusions would be of significant utility for planetary protection and preliminary screening protocols during a Mars sample return mission.

Reference as:

Mormile, M. R. and M. C. Storrie-Lombardi (2005). The use of ultraviolet excitation of native fluorescence for identifying biomarkers in halite crystals. *Astrobiology and Planetary Missions*. R. B. Hoover, G. V. Levin, A. Y. Rozanov and G. R. Gladstone, Eds. SPIE. Bellingham, WA. San Diego, 5906: 246-253.